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SUBJECT Components with Nomenclature of Wind Tunnel at Gorodomlya Island

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SOURCE: [redacted]

1. Construction of the wind tunnel unit was started in winter 1949 and was completed in fall 1950. Upon completion of the tunnel, testing was initiated and a total of three to four tests per week were run under the direction of Prof. Frieser [redacted] I have no knowledge of tests run in the tunnel nor the test results. According to the Soviets, the tunnel came directly from Moscow, but it was the general belief of the Germans that it was built in Podlipki. Actual construction of the tunnel and installation of the component parts was under the direction of Ing. Jaffke. 25X1A

2. The choker was built in Ostashkov and the rapid closing valve was built in Podlipki. The design for the rapid closing valve was completed at Ostashkov, submitted to Podlipki for fabrication, and the part, when completed, returned to Ostashkov for installation in the wind tunnel assembly. The quality of machine work done on this particular valve in Podlipki was extremely poor. All parts of the valve required reworking in the shops at Ostashkov prior to assembly in the test set up. I do not know the operational limits of the tunnel, other than the fact that it was a supersonic tunnel for experiments with models. The complete number of units which comprised the wind tunnel test installation are as follows: 25X1A

[redacted]

a. 36 air bottles (200 atmospheres)
b. 6 quick closing valves (part 8)
c. 6 control valves (part 7)
d. 12 electromagnetic valves (part 4 and 13)
e. 12 non-return valves (part 5 and 10)
f. 12 shutter (bleed) valves (part 6 and 14)
g. 4 air bottles (45 atmospheres)
h. 6 air drying bottles

OPERATING DATA

3. In order to operate the wind tunnel: (See diagram, page 7.)

a. Turn the compressor on.
b. Open valve 1 and 2 and fill the control air reservoir until the safety valve (part 15) blows. The reservoir then contains 45 atmospheres.
c. Close valve (part 2) manually.
d. Open valve (part 3). The unit is then ready for the filling of the rows of air bottles.
e. Pe-4 valve (part 4) is opened electrically. Forty-five atmospheres of pressure now flow through the non-return valve (part 5) which opens, through shutter valve (part 6), through the control valve (part 7), and through space A of the quick closing valve. Through this pressure, the quick closing valve is pressed tightly against its base B, thereby sealing off the row of air bottles.
f. Open valve (part 9). The compressor now provides compressed air to the row of air bottles. If the air pressure rises to 46 atmospheres, the non-return valve (part 10) opens and the non-return valve (part 5) closes. The Pe-4 valve (part 4) can then be switched off. The pressure from the row of air bottles now automatically takes over the sealing of the quick closing valve and allows the pressure in the row of air bottles to rise to 200 atmospheres. Safety valve (part 11) prevents the pressure rising above 200 atmospheres. At this point, the unit is ready for the operation of the wind tunnel.

g. The choker valve (part 12) is electrically set to the desired mach number required for tunnel operation. The mach number is dependent upon the cross sectional flow of the air in the piping and it is by variation of this cross sectional area in the choker valve itself that the mach number is maintained.

h. Pe-4 valve (part 13) is electrically opened allowing 45 atmospheres of pressure to pass through this tube to the large piston of the control valve whereupon the flow of two hundred atmospheres from the air bottles is stopped and, simultaneously, space A of the quick closing valve is evacuated. The piston of the quick closing valve is, therefore, opened by the pressure in space C. The variable shutter/(aperture) valve (part 14) is installed in the line to regulate the opening time. The high pressure air now steams out of space C, through the choker valve (part 12), through the deflector vanes and nozzle, into the wind tunnel proper.

i. If, for any reason, the experiment is to be interrupted, or the air bottles are not completely evacuated, Pe-4 valve (part 13) is de-energized. Tube A is evacuated, control valve (part 7) reverses to its original, or starting position, and once again high pressure from the row of air bottles passes through the non-return valve (part 10) and shutter valve (part 6) into space A of the quick closing valve, thereby sealing off space C. The unit is then completely cut off from the wind tunnel proper and is again ready for a controlled flow to the tunnel.

j. If, for any reason, the unit is to operate on pressures lower than 45 atmospheres, then the reservoir pressure must be decreased so that the controlled air pressure is one atmosphere lower than the air pressure in the row of air bottles.

METHOD OF OPERATION WITH RAPID CLOSING VALVE

4. The rapid closing valve is a completely pneumatic valve, the piston of which, in the initial position, is seated by an excess force of 5,240 kg., with space A and B maintaining 200 atmospheres of pressure. (See diagram, page 8.) Opening of the valve is activated by evacuating the pressure from space A. The excess force of 5,240 kg. is, therefore, removed and the piston (part 9) is displaced to the right with the force of 11,640 kg. The 200 atmospheres of pressure then pass from space B to C and on through the various valves to the wind tunnel proper. To close the valve, space A is again filled with 200 atmospheres of pressure seating the piston (part 9) with an excess pressure of 5,240 kg. as indicated above. In general, the opening and closing of the valve is regulated by apertures or bleeds, which regulate the speed of the exhaust and intake of the high pressure air into space A. This controlled bleeding prevents the piston from striking the bottom cylinder casting or seat with too great a force. The time required for opening and closing of the valve is 15 to 20 seconds. I have included formulas for the computation of various pressures existing in the valve. (See diagram, page 9.) These pressure values deviate only slightly from those pressures existing in the actual valves in operation at Ostashkov. The following is a parts list of the rapid closing valve, including a description for each part and the method of fabrication for the part.

COMPONENTS OF THE RAPID CLOSING VALVE

5. The parts of the rapid closing valve are as follows:

Part	Designation	Method of Manufacture
1.	Housing	Square block (a milled part)
2.	Valve seat	(Drehteil) Lathed part
3.	Ring nut	Lathed part
4.	Copper gasket	Stamped metal part
5.	Bushing guide	Lathed part
6.	Ring nut	Lathed part
7.	Bearing	Lathed part
8.	Collar	Casting
9.	Piston	Lathed part
10.	Valve disk	Lathed part
11.	Copper gasket	Stamped metal
12.	Bolt	Lathed part

Part	Designation	Method of Manufacture
13.	Collar	Molded part
14.	Bearing	Lathed part
15.	Ring nut	Lathed part
16.	Cylinder	Lathed part

SOVIET NOMENCLATURE FOR PARTS

6. Soviet designations for the above parts of the rapid closing valve are as follows:

Part	Material (Soviet Standard Designation)	Remarks
1.	81T	-Stainless steel. Tensile strength 45 kg./mm^2.
2.	ЭЖ II	-Heat-treatable stainless steel. Tempered to 120 kg./mm^2. Tensile strength untreated 60 kg./mm^2.
3.	СТ35 ГОСТ В 1050-41	-Steel with tensile strength of 45 kg./mm^2. Rust protection: Browning antirust treatment (Bruenierung).
4.		-Copper gasket; soft copper.
5.	СТ45 ГОСТ В 1050-41	-Steel with tensile strength of 60 kg./mm^2. Rust protection: Browning antirust treatment.
6.	СТ35 ГОСТ В 1050-41	-Steel with tensile strength of 45 kg./mm^2. Rust protection: Browning antirust treatment.
7.		-Bearing. Bearing bronze.
8.		-Collar. Buna rubber.
9.	ЭЖ I	-Heat-treatable stainless steel, Tempered to 90 kg./mm^2. Tensile strength untreated 50 kg./mm^2.
10.	ЭЖ I	-Heat-treatable stainless steel used untreated. Tensile strength 50 kg./mm^2.
11.		-Copper gasket. Soft copper.
12.	СТ45 ГОСТ В 1050-41	-Steel. Tensile strength 60 kg./mm^2. Rust Protection: Browning antirust treatment.
13.		-Collar. Buna rubber.
14.		-Bearing. Bearing bronze.
15.	СТ45 ГОСТ В 1050-41	-Steel. Tensile strength 60 kg./mm^2. Rust protection: Browning antirust treatment.
16.	ЭЖ II	-Heat-treatable stainless steel. Treated to 90 g/mm^2. Tensile strength untreated 60 kg./mm^2.

PURPOSE OF CONTROL VALVE

7. The functions of this three-way control valve are three fold. (See diagram, page 9)

a. To allow passage of 200 atmospheres of pressure to the rapid closing valve when the 45 atmospheres of back pressure is not present.

b. To seal off the flow of high pressure air (200 atmospheres) to the rapid closing valve when 45 atmospheres of back pressure are applied to the piston.

c. To evacuate space A of the rapid closing valve. (See diagram, page 8.)

METHOD OF OPERATION WITH CONTROL VALVE

8. Both pistons (part 6 and 14) are pressed to the right by the springs (part 4 and 12), which are built into these pistons. The piston (part 6), therefore, seals off the way to the atmosphere. The sealing at seat II is maintained by the constant pressure of 200 atmospheres existing to the left of piston (part 6). Therefore, 200 atmospheres of pressure flow constantly through spaces B, C, D, E, F, G, H, and I, to the rapid closing valve. If a control pressure of 45 atmospheres is applied to the piston (part 14), then the piston moves to the left with a force of approximately 600 kg. and presses with its bearing (part 15) on the control rod (part 13), which in turn presses on the small piston (part 6) which forces this piston through a full travel, sealing off the 200 atmospheres of pressure at seat I. The 200 atmospheres of pressure are therefore sealed off and can travel only into space E. Space A of the rapid closing valve is then evacuated through spaces I, H, G, F, K, L, M, and N, to the atmosphere. (See diagram, page 9.)

SOVIET NOMENCLATURE FOR PARTS OF CONTROL VALVE

9. The following is a parts list of the control valve, including a description of the material used for each part and the method of fabrication for the part: (See diagram, page 9.)

Part	Material (Soviet Standard Designation)	Remarks
1.	30ХГСА	- Alloy steel with a tensile strength (Festigkeit) of 75 kg./mm^2.
*2.		- Soft copper.
3.	30ХГСА	- Alloy steel with a tensile strength of 75 kg./mm^2.
4.	П II	- Soviet spring wire with a tensile strength (Zerreissfestigkeit) of 190 kg./mm^2.
5.	30СГСА	- Alloy steel, heat-treated to a tensile strength of 75 kg./mm^2.

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Part	Material (Soviet Standard Designation)	Remarks
*6.		- Brass
*7.		- Hard rubber
*8.		- Soft copper
*9.		- Bronze
*10.		- Duralumin (Dural)
11.	СТ35 ГОСТ В 1050-41	- Steel with tensile strength of 60 kg./mm^2, weldable.
12.	СТ25 ГОСТ В 1050-41	- Steel with tensile strength of 45 kg./mm^2, weldable.
13.	П II	- Soviet spring wire with a tensile strength of 190 kg./mm^2.
*14.		- Silver steel (Silberstahl)
15.	Я 1 Т	- Heat-resisting stainless steel with tensile strength of 45 kg./mm^2; weldable.
*16.		- Carburizing steel (Einsatzstahl). Surfaces were tempered.
*17.		- Rubber sleeve made of Buna.
18.	Я 1 Т	- Soviet heat-treatable, heat-resisting stainless steel. Tensile strength of 60 kg./mm^2.
19.	ЭЖ II	- Soft copper
*20.		
21.	СТ25 ГОСТ В 1050-41	
22.	СТ35 ГОСТ В 1050-41	

* [Source could not recall designation.]

Page 7 - Schematic Design for Wind Tunnel

Page 8 - Rapid closing Valve

Page 9 - Control Valve

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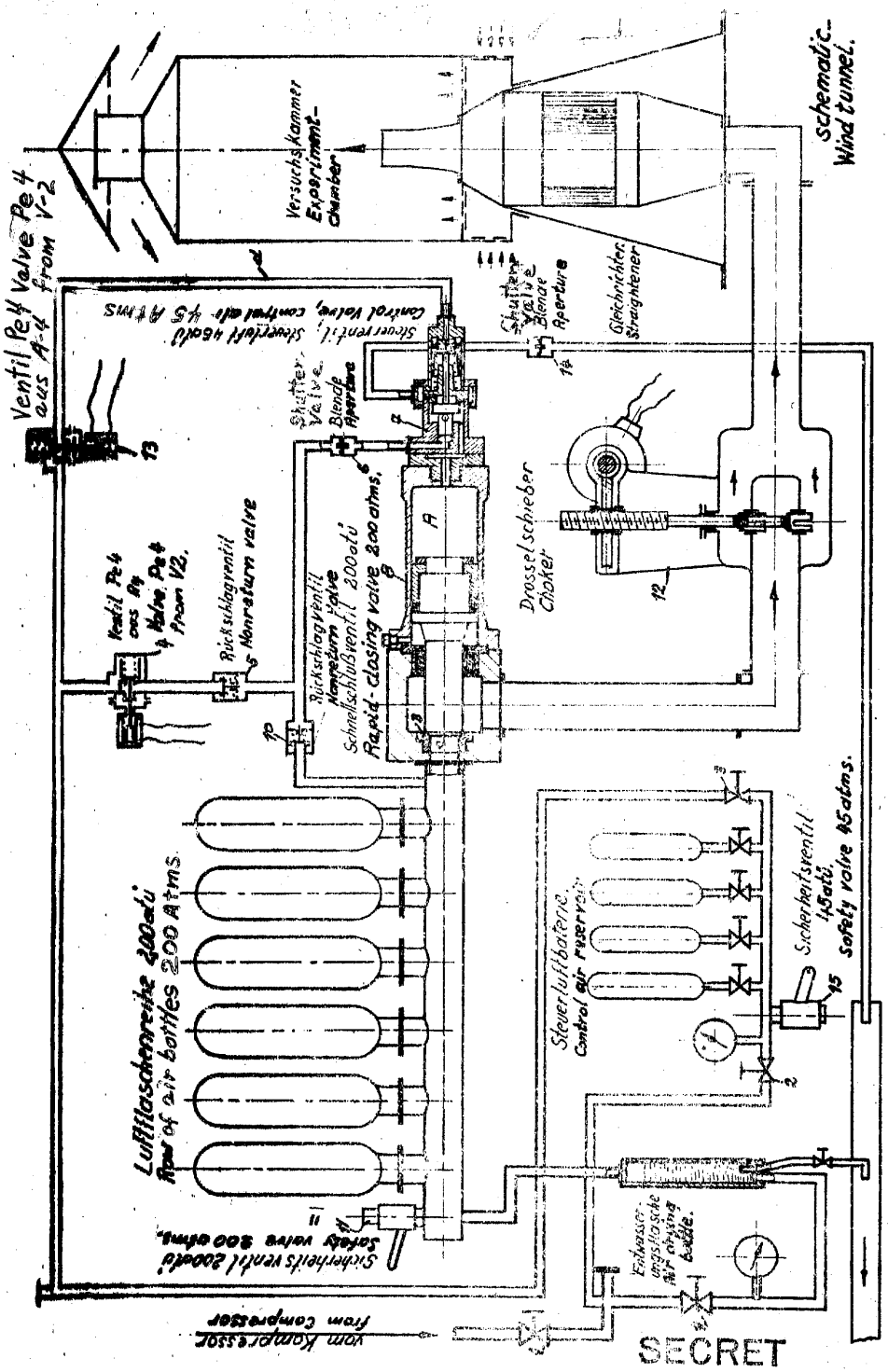

SCHEMATIC of WINDTUNNEL

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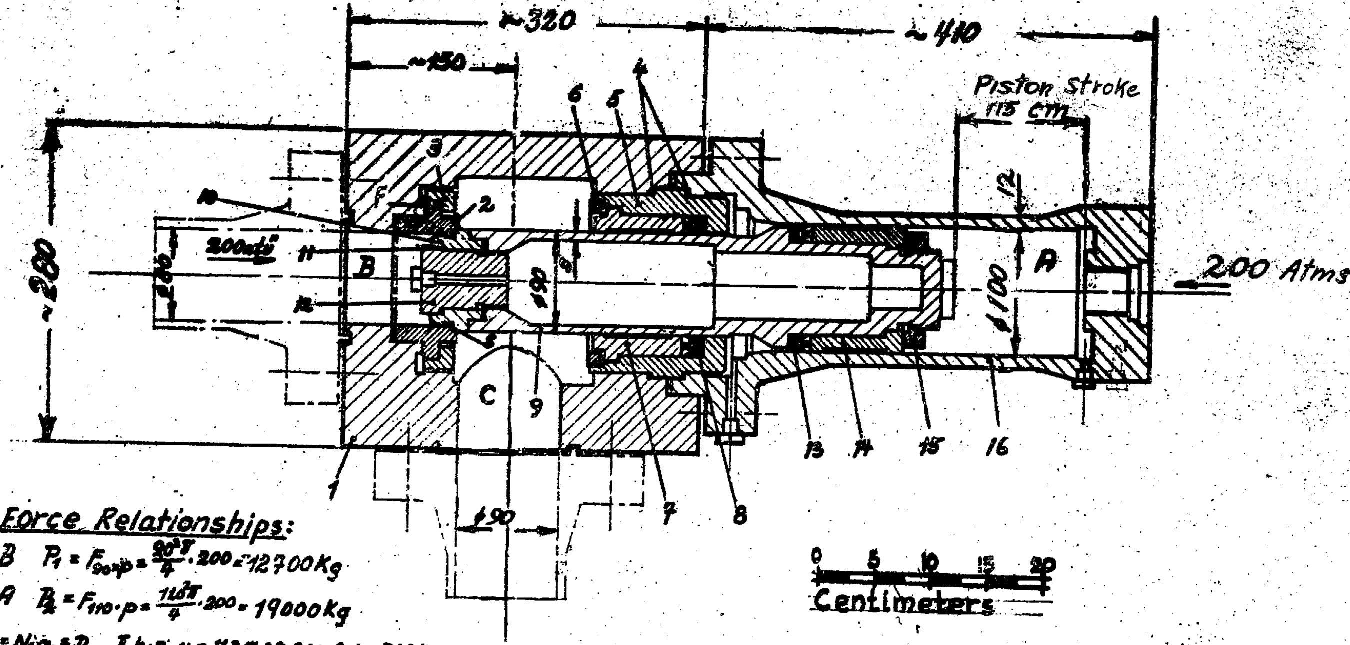

Schnellschlußventil 200atü M 1:5

Kraftverhältnisse: **Force Relationships:**

(a) Kraft auf Kolben im Raum B $P_1 = F_{90} \cdot p = \frac{9{,}0^2 \pi}{4} \cdot 200 \approx 12700$ Kg

(b) Kraft auf Kolben im Raum A $P_2 = F_{110} \cdot p = \frac{11{,}0^2 \pi}{4} \cdot 200 = 19000$ Kg

(c) Reibung in Manschette (13) $P_3 = N \mu = D_{110} \cdot \pi \cdot h \cdot p \cdot \mu = 11{,}3 \cdot \pi \cdot 0{,}8 \cdot 200 \cdot 0{,}1 = 560$ Kg

(d) Reibung in Manschette (8) $P_4 = N \mu = D_{90} \cdot \pi \cdot h \cdot p \cdot \mu = 9{,}2 \cdot \pi \cdot 0{,}8 \cdot 200 \cdot 0{,}1 = 500$ Kg

(e) Überschußkraft $P = P_2 - (P_1 + P_3 + P_4) = 19000 - (12400 + 560 + 800) = 19000 - 13760 =$ 5240 Kg

(a) Force on Piston in space "B" ...
(b) Force on Piston in space "A" ....
(c) Friction in Sleeve "13" ....
(d) Friction in Sleeve "8" ...
Surplus force ...

RAPID CLOSING VALVE - 200 atm.

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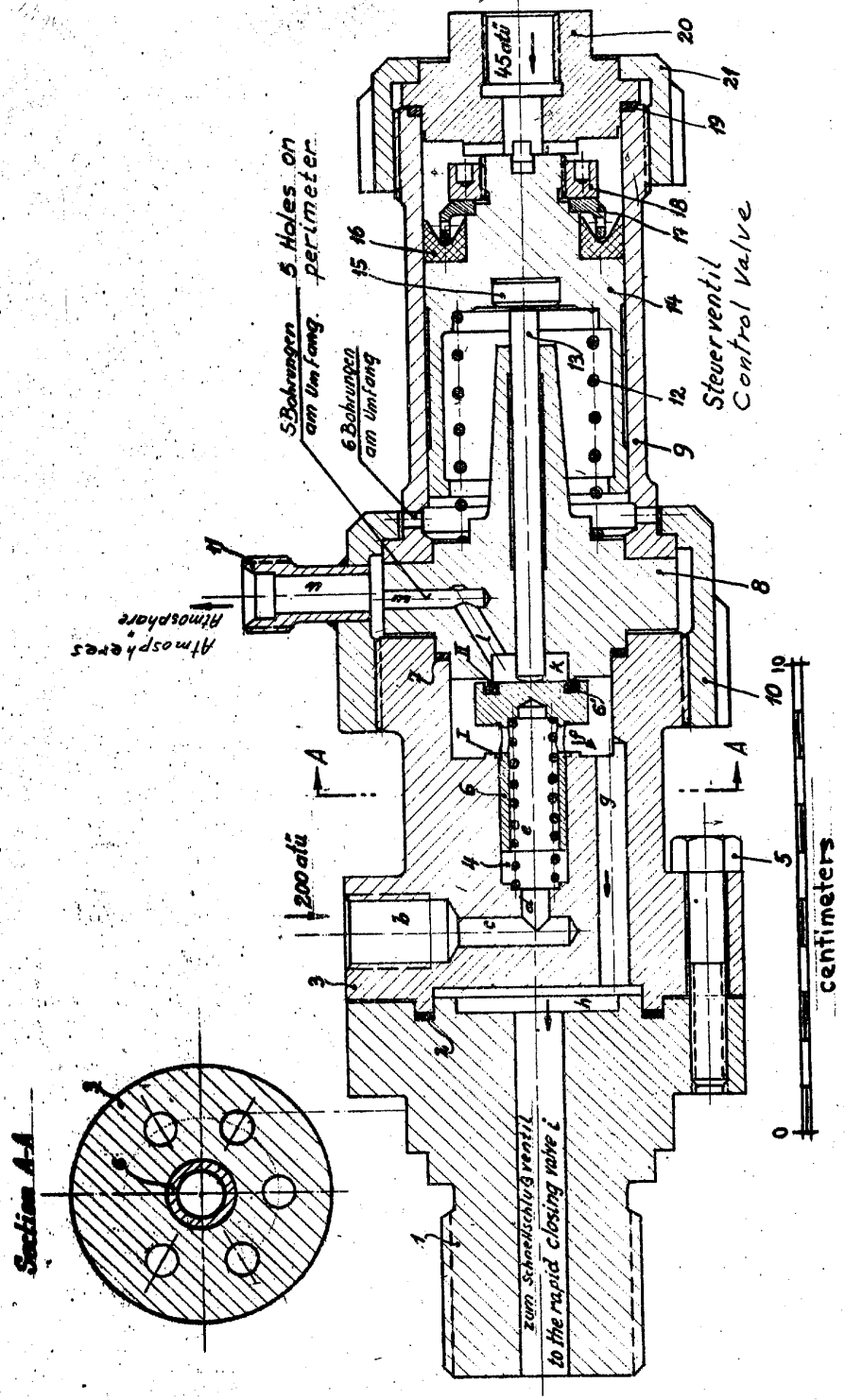

CONTROL VALVE